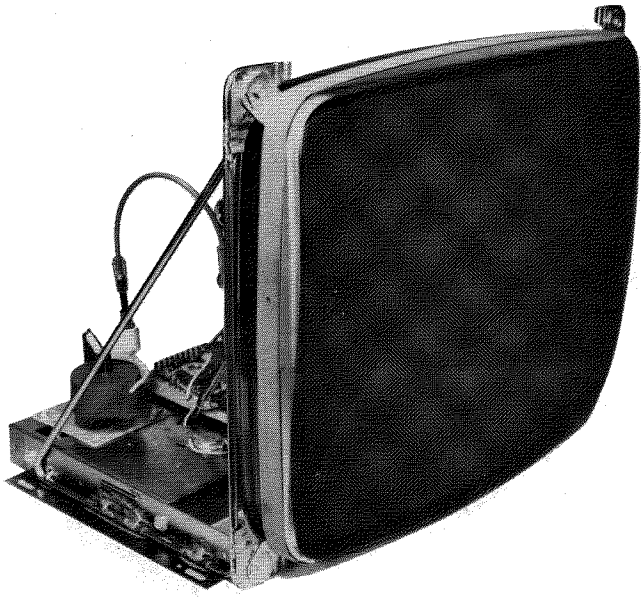
wells-gardner electronics corporation

BLACK AND WHITE TV MONITORS



MODELS

V1001—CHASSIS ONLY
19V1001—19" CRT
19V1003—19" CRT
22V1001—23" CRT
22V1003—23" CRT

SERVICE MANUAL AND PARTS CATALOG

GENERAL INFORMATION

The video display monitor is intended for the video game market. There are two models available and only differ in picture tube size and CRT mounting.

The main sections of the monitor are the power supply section, video section and vertical and horizontal deflection circuitry. AC power and composite video information are fed to the monitor through a 12 pin receptacle located on the rear panel.

A major part of the circuitry is located on a plug-in circuit board. A voltage regulator transistor and horizontal deflection transistor are mounted on the metal chassis which also serves as a heat sink for these devices.

Component reference numbers and circuit legend are printed on the circuit board to aid in servicing.

The picture tube is securely mounted to the chassis by brackets to create the complete unit. The picture tubes used all have implosion protection.

Rear panel controls include contrast, brightness, vertical hold, horizontal hold and width control. Additional service controls are mounted on the circuit board, and are accessible from the rear of the chassis.

ELECTRICAL SPECIFICATIONS

Power Rating: 58 watts nominal

Source: 100/120/230V AC @ 50/60 Hz
voltage tap selected

Video Input: 0.5 to 2.5 volts P/P composite
(sync. negative)

CAUTION

NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

WELLS-GARDNER ELECTRONICS
CORPORATION
2701 NORTH KILDARE AVENUE
CHICAGO, ILLINOIS 60639
312—252-8220

IMPORTANT SERVICE NOTES

Work on these models should only be performed by those who are thoroughly familiar with precautions necessary when working on high voltage equipment.

Exercise care when servicing this chassis with power applied. Many B plus and high voltage RF terminals are exposed which, if carelessly contacted, can cause serious shock or result in damage to the chassis. Maintain interconnecting ground lead connections between chassis and picture tube dag when operating chassis.

Certain HV failures can increase X-ray radiation. Monitors should not be operated with HV levels exceeding the specified rating for their chassis type. The maximum operating HV specified for the chassis used in these monitors is **16**KV ± 1KV at zero beam current with a line voltage of 120V AC and B+ adjusted for **75** V DC. Higher voltage may also increase possibility of failure in HV supply.

It is important to maintain specified values of all components in the horizontal and high voltage circuits and anywhere else in the receiver that could cause a rise in high voltage, or operating supply voltages. Refer to the Parts List and use ONLY exact replacement parts; especially picture tubes, semiconductor devices, transformers, coils, fuses and circuit breakers.

To determine the presence of high voltage, use an accurate high impedance, HV meter connected between second anode lead and metal chassis frame only. When servicing the High Voltage System, remove static charge from it by connecting a 10K ohm resistor in series with an insulated wire (such as a test probe) between picture tube dag and 2nd anode lead. (AC line cord disconnected from chassis.)

The picture tube used in this monitor employs integral implosion protection. Replace with tube of the same type number for continued safety. Do not lift picture tube by the neck. Handle the picture tube only when wearing shatterproof goggles and after discharging the high voltage completely. Keep others without shatter-proof goggles away.

Before returning the monitor to user, perform the following safety checks:

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the monitor.

2. Replace all protective devices such as non-metallic control knobs, insulating fishpapers, adjustment and compartment covers or shields.

3. To be sure that no shock hazard exists, a check for the presence of leakage current should be made at each exposed metal part in the following manner:

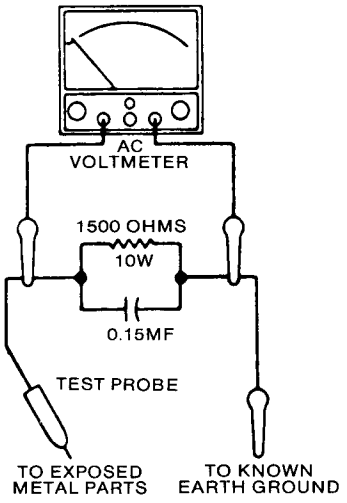
Plug the AC line cord directly into a 120 VAC receptacle. (D0 not use an Isolation Transformer during these checks.) All checks must be repeated with the AC line cord plug connections reversed. The chassis ground return lead should not be connected for this test.

If available, measure current using an accurate leakage current tester. (Use Standard Equipment Item No. 21641.) Any reading of 0.5 MA or more is excessive and indicates a potential shock hazard which must be corrected before returning the monitor to the owner.

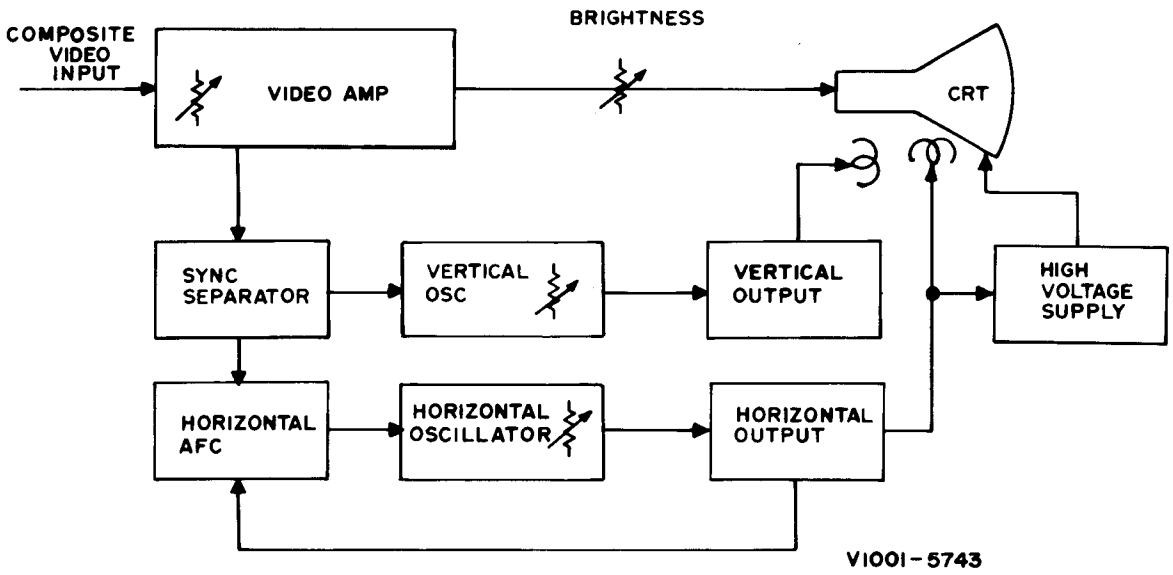
If a reliable leakage current tester is not available, this alternate method of measurement should be used. Using two clip leads, connect a 1500 ohm, 10 watt resistor paralleled by a 0.15 MF capacitor in series with a known earth ground, such as a water pipe or conduit and the metal part to be checked. Use a VTVM or VOM with 1000 ohms per volt, or higher, sensitivity to measure this AC voltage drop across the resistor. Any reading of 0.75 volt RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the monitor to the owner.

PRODUCT SAFETY PARTS REPLACEMENT

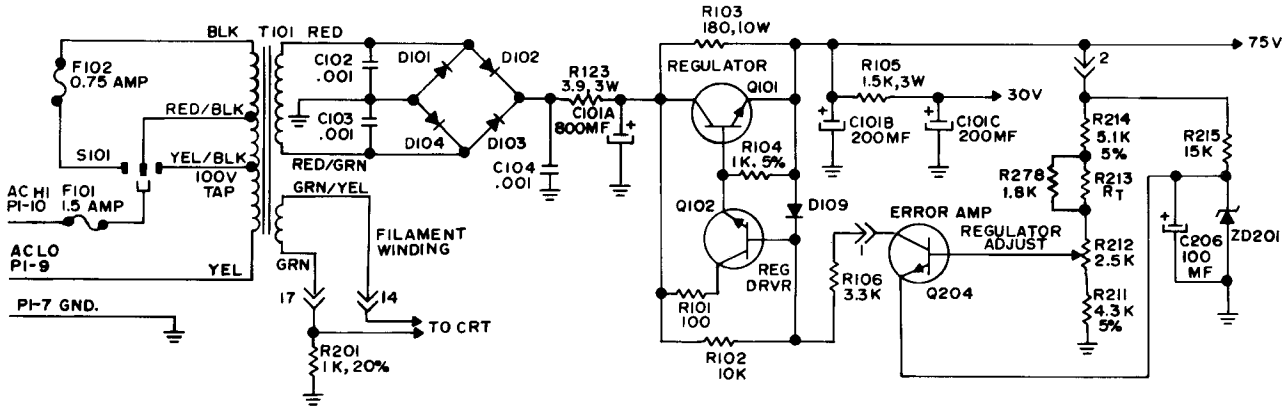
Many electrical and mechanical parts in video monitors have special safety related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified by ★ on the Parts List in this Manual and are shown in shaded areas on the Schematic Diagram. The use of a substitute replacement which does not have the same safety characteristics as the recommended replacement part shown in the Parts List in this Service Manual may create shock, fire or other hazards.



THEORY OF OPERATION



BLOCK DIAGRAM



POWER SUPPLY

POWER SUPPLY

The power supply system provides a regulated 75 volt output which supplies the horizontal deflection and vertical deflection circuits. The 75 volt output also supplies current for the 30 volt and 15 volt outputs. The system is designed to reduce output voltage variations due to changes in the A.C. input voltage or changes in output load current.

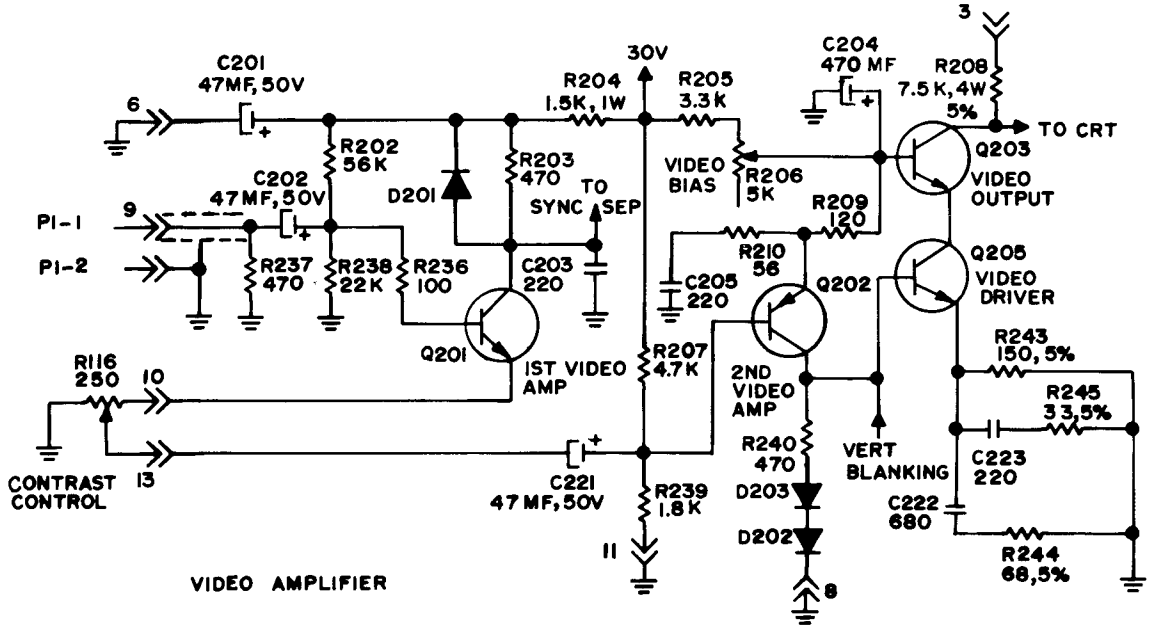
The power supply consists of a transformer operated system utilizing a full wave bridge rectifier to supply the series pass regulator Q101 and its associated current shunt R103. The primary of the power transformer has three input taps to provide operation from any one of three possible A.C. supply lines, namely 100V, 120V or 230V, 50 or 60 Hz. The regulator Q101 is driven by regulator driver Q102. The error amplifier will control the conduction of the cascaded current amplifiers Q101 and Q102.

Protection of the base emitter junctions of both Q101 and Q102, during voltage transients, is accomplished by diode D109.

R213, which is part of the voltage divider in the error amplifier input, is a temperature sensitive device which is used to reduce variations in output voltage at operating temperatures between 0 degree to 55 degree centigrade.

The circuit regulates the output voltage by sampling the output voltage at the base of Q204. Q204 compares this voltage to zener diode reference voltage connected to the emitter of Q204. An increase in the output voltage would cause an error voltage which would instantly be corrected by an increase in conduction of Q204 and a decrease in conduction of Q102 and Q101.

THEORY OF OPERATION



VIDEO AMPLIFIER

The video amplifier consists of four stages incorporating active devices Q201, Q202, Q203 and Q205. The first stage Q201 provides two outputs, video drive for the sync separator is developed at the collector and the emitter output is used to drive the following stage Q202.

Q203 and Q205 are connected in a cascode arrangement with Q205 being directly driven by Q202. This circuit configuration provides an improved frequency response as compared to a base driven video output amplifier.

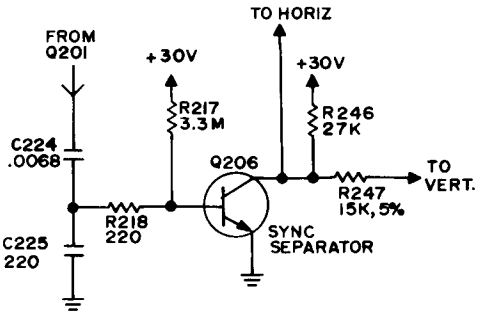
Diodes D202 and D203 are used to reduce the effects of temperature on the video output amplifier. Diode D201 provides protection from voltage transients for Q201.

The video bias control is a factory adjustment used to set the quiescent collector voltage of video output amplifier Q203.

The video amplifier output is direct coupled to the control grid of the CRT through R113 which is used to isolate Q203 from transients that may occur as a result of CRT arcing.

SYNC SEPARATOR

The sync separator employs transistor Q206 to recover sync from the composite video signal. The video input to the sync separator is sync positive. C224 is charged by the peak base current that flows when the positive peak of the input drives Q206 into saturation. This charge depends on the peak positive composite video input to C224. The rc time constant of C224 and R217 provides a long discharge time in relation to the horizontal sync interval. The charge on C224 will establish a clip level for Q206 in order to remove the sync information. The output of Q206 contains the inverted and amplified sync pulses for horizontal and vertical synchronization.



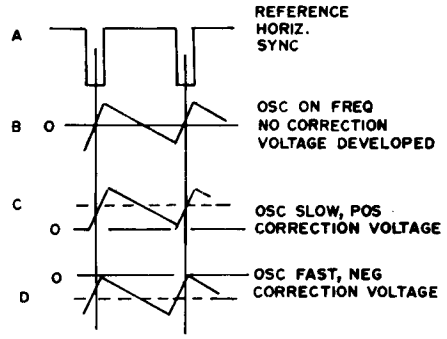
SYNC SEPARATOR

V1001-5745

PHASE DETECTOR

The phase detector is operating with two inputs, one from horizontal flyback pulse and one from horizontal sync. The required output must be of correct polarity and amplitude to correct phase differences between the input sync and the horizontal time base. The horizontal collector pulse is integrated into a sawtooth by R216 and C210.

If the horizontal time base is in phase with the sync, net charge on C210 will be zero. (Since the current through D205A and R221 at positive half of sawtooth and the current through D205B and R220 at negative half of sawtooth are equal). If the horizontal time base is leading the sync, the sawtooth on C210 will be clamped at a point positive from its AC axis, resulting in a net negative charge on C210 which is the required polarity to slow the horizontal oscillator. For filtering purposes to eliminate video ringing or hunting, R222, C212, C211 and R225 are added. C208 is added to correct horizontal centering of the picture on the raster.



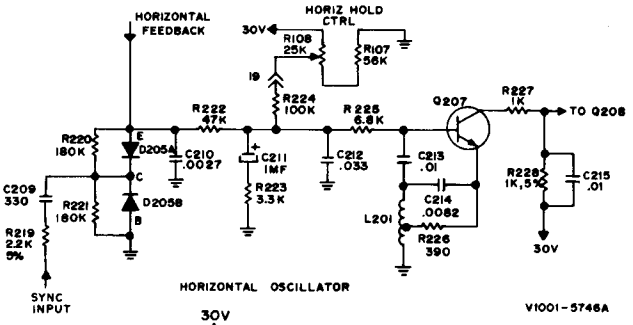
PHASE DETECTOR WAVE FORMS

V1001-5747

THEORY OF OPERATION

HORIZONTAL OSCILLATOR

A Hartley type oscillator is used. The operating frequency of this oscillator is sensitive to the base input voltage of Q207. This permits control by the output of the phase detector and also by the setting of the horizontal hold control R108. The horizontal hold range is set by adjustment of the core of L201.



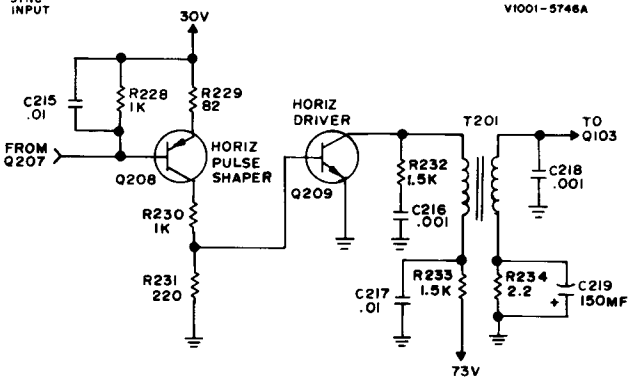
PULSE SHAPER AND HORIZONTAL DRIVER

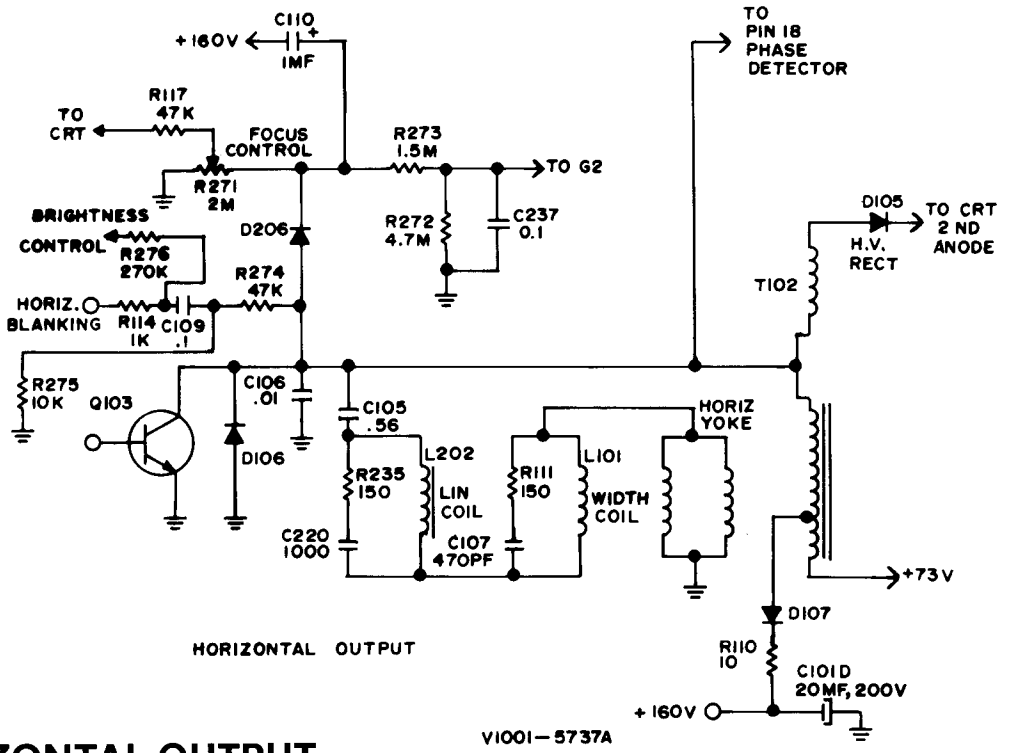
Q208 serves as a buffer between the oscillator and the driver to provide isolation for the horizontal oscillator as well as a low impedance drive for the horizontal driver.

R228 and C215 form a time constant which shapes the oscillator output to the required 50% duty cycle to drive the horizontal driver stage.

Q209 operates as a switch to drive the horizontal output transistor through T201.

R232 and C216 provide damping to eliminate ringing of the primary of T102 when Q209 goes into cutoff.





HORIZONTAL OUTPUT

Q103 which operates as a switch, conducts during the period between turn off of damper diode and end of scan. The collector current flows through the flyback and yoke with a ramp waveshape. The maximum level the collector current will reach is determined by the B† voltage, the parallel inductance value of flyback/yoke coils, and the amount of time the horizontal output transistor is switched on, which is approximately 45% of the total horizontal line period. The retrace period occurs immediately after the collector current has been turned off, which was initiated by the reversal of the base current. R234 and C219 form a time constant for fast turn off of the base of Q103. The retrace pulse charges C110 through D206 to provide operating voltage for G2 of the crt. Momentary transients at the collector of Q103, should they occur, are limited to the voltage on C110 since D206 will conduct if the collector voltage exceeds this value.

The damper diode D106 conducts during the period between retrace and turn on of Q103. C106 is the retrace tuning capacitor. C105 blocks DC from the deflection yoke. L202 is a magnetically biased linearity coil which shapes deflection current for optimum trace linearity. L101 is a series width control. C220 and R235, C107 and R111 are damping network components for the linearity and width controls.

VERTICAL OSCILLATOR DRIVER AND OUTPUT

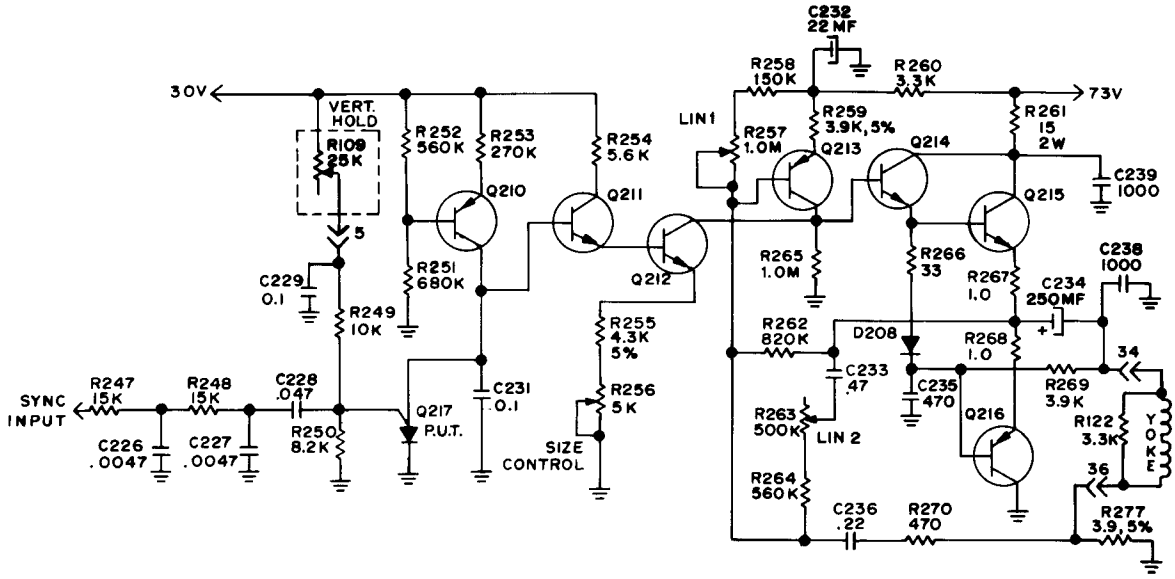
In the oscillator, transistor Q210 acts as a constant current source to charge capacitor C231. Thus, the voltage across C231 increases linearly with time. Capacitor C231 is discharged by the programmable unijunction transistor (put) Q217. Q217 will turn on if the free running frequency of the oscillator which is controlled by the gate voltage level with R109 is close to that of the negative going sync pulses. Q211 serves as a buffer between the oscillator and the amplifier to prevent non linear charging of capacitor C231.

In the amplifier, Q212 serves as a voltage controlled current source. Q213 acts as a constant current source such that Q214 and Q215 are turned on when the oscillator voltage is low. As the oscillator voltage increases increasing Q212 collector current, decreasing base current of Q214, Q214 and Q215 will be cut off and Q216 will conduct.

Beginning of retrace time zero oscillator voltage cuts off Q212. Q214 and Q215 become biased on and Q216 biased off. However, since current cannot change abruptly through inductive load yoke, suddenly output voltage will increase. Since Q213 is biased through R262, during retrace time high output voltage causes Q213, Q214 and Q215 to cutoff and Q216 to turn on (due to low voltage drop through R269) until the yoke current goes to zero. When the yoke current (output current) reaches zero, the output voltage begins to fall. This causes Q215 to turn on and Q216 to turn off, thus, completing the current reversal.

In order to maintain linearity, and desired s-correction, current feedback is provided by R277, R258, R257 and C236, and second AC feedback is used by R263, R264 and C233.

Height control is achieved by varying the collector current swing in transistor Q212 with potentiometer R256.



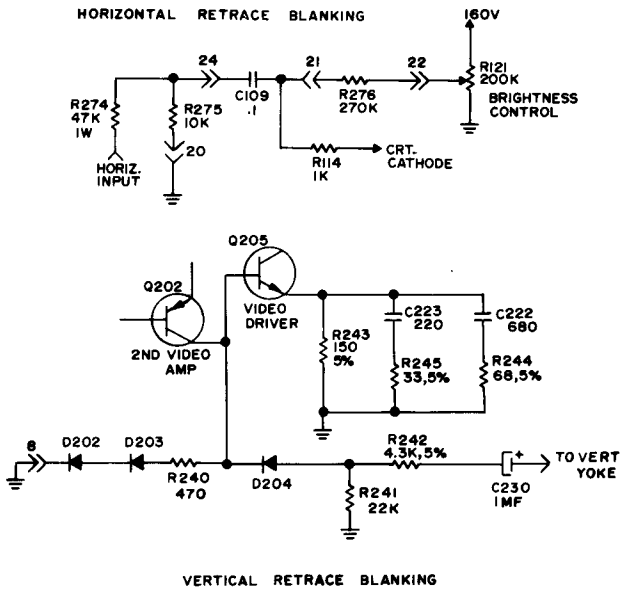
VERTICAL OSCILLATOR DRIVER & OUTPUT

V1001-5738B

RETRACE BLANKING

Vertical retrace blanking is accomplised by applying a positive pulse to the base of the video driver Q205. Diode D204 is used to block the sawtooth portion of the vertical wave form. The blanking pulse will appear at the collector of the video output amplifier which is directly coupled to CRT grid.

Horizontal retrace blanking is provided by a positive pulse applied to the CRT cathode. This pulse originates at the collector of the horizontal output device. The pulse amplitude is reduced by voltage divider R274 and R275. C109 is used to couple this blanking pulse to the CRT.



VERTICAL RETRACE BLANKING

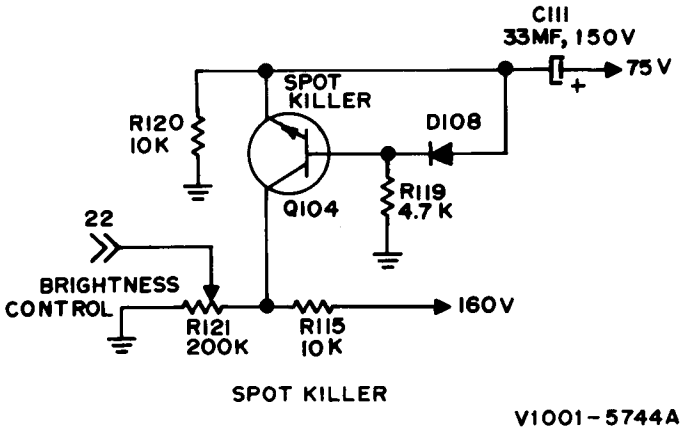
V1001—5739

THEORY OF OPERATION

SPOT KILLER

Q104 is used to prevent the CRT beam from reaching a spot when the unit is turned off. Q104 is in a non conducting state when the monitor is in operation.

The circuit operates by allowing C111 to charge to the 75V supply voltage when the monitor is turned on. C111 will discharge when power is removed from the monitor. Some discharge current will flow through the emitter base of Q104 and R119. Q104 will be in a conducting state and will reduce the positive potential at the CRT cathode. The CRT will increase in beam current during the turn off period to discharge the high voltage system.



SPOT KILLER

V1001-5744A

VOLTAGE INPUT SELECTOR

This chassis is designed to operate on any one of three input power sources.

Before power is applied to the chassis, the tap selector should be connected to agree with power input which will be applied to the monitor, namely 100V or 120V or 230V AC 50/60 Hz.

The tap selector is located under a protective cover near the power transformer T101.

CIRCUIT TRACING

Component reference numbers are printed on top and bottom of the plug-in circuit board to facilitate circuit tracing. In addition, terminal numbers are also shown and are referenced on the chassis schematic diagram in this manual.

Transistor elements are identified as follows:

E - emitter, B - base, and C - collector.

COMPONENT REMOVAL

Removing components from the etched board is facilitated by the fact that the circuitry (plating) appears on one side of the board only and the component leads are inserted straight through the holes and are not bent or crimped.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature controlled heating element would be desirable since it would reduce the possibility of damaging the board due to over-heating.

The nozzle of the soldering gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away leaving the lead free from the copper plating. This method is particularly suitable in removing multi-terminal components.

REGULATOR ADJUSTMENT

NOTE: Misadjustment of the low voltage regulator or the horizontal oscillator may result in damage to the Horizontal Output Transistor or pulse limiter diode. The following procedures are recommended to insure reliable operation.

1. Connect monitor to AC line supply.

2. Apply test signal to proper input. Signal should be of same amplitude and sync rate as when monitor is in service.

3. Adjust vertical and horizontal oscillator controls until display is in synchronization.

4. Connect a DC digital voltmeter or other precision accuracy voltmeter to the emitter of the regulator output transistor, (or any 75 volt test point).

5. Adjust the regulator control R212 on circuit board for an output of 75 volts. Do not "run" the regulator control through its range or damage to the monitor may result.

6. When adjustment is complete, the AC line supply can be varied between † 10% and - 10% of nominal volts to check for proper regulator operation. With regulator operating properly, changes in display size should be negligible.

HORIZONTAL OSCILLATOR ADJUSTMENT

1. Set the horizontal hold potentiometer to mid-range (R108).

2. Adjust core of horizontal hold coil (L201) until the horizontal blanking lines are vertical.

3. Rotate potentiometer (R108) through ite full range. Display should go out of sync in each direction and hold in sync at the center of its range. Retouch L201 as necessary to center the hold range.

THEORY OF OPERATION

VIDEO AMPLIFIER BIAS ADJUSTMENT

Adjust video bias control (R206) for 45 volts DC on collector of video output transistor (Q203) with no signal input.

Disconnect cable from video input jack if necessary to eliminate noise.

POWER TRANSISTOR REPLACEMENT

When replacing any "plug-in" transistor, i.e., the regulator or horizontal output, please observe the following precautions:

1. *The transistor sockets are not "Captive"*, that is, the transistor mounting screws also secure the socket. When installing the transistor, the socket must be held in its proper location. This location is indicated by flanges on the socket which fit into the heat sink.

2. When replacing the output transistors, silicone grease should be applied evenly to both sides of the mica insulator.

3. All transistors mounting screws must be tight before applying power to the monitor. This insures proper cooling and electrical connections.
NON-COMPLIANCE WITH THESE INSTRUCTIONS CAN RESULT IN FAILURE OF THE TRANSISTOR AND/OR ITS RELATED COMPONENTS.

NOTE: Use caution when tightening transistor mounting screws. (Torque 7 to 10 inch lbs.). If the screw threads are stripped by excessive pressure, a poor electrical and mechanical connection will result.

CRT REPLACEMENT

Use extreme care in handling the CRT as rough handling may cause it to implode due to atmospheric pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection.

1. Discharge CRT by shorting 2nd anode to ground. Remove CRT socket, yoke and 2nd anode lead.

2. Remove CRT from chassis by removing four screws at corners.

CIRCUIT BOARD REMOVAL/ INSTALLATION

To prevent damage to the board or foil when removing the circuit board it may be necessary to pry up slowly, IN STAGES around the edges. Start at one corner and move all around the board keeping the screwdriver tip against the chassis. When installing, apply pressure at the edges near the pins. Do not force down on the components.

SERVICE NOTES

A. VISUAL INSPECTION:
Check video display and operation of service controls. Inspection of components in related circuits may disclose a short circuit, broken lead or component overheating.

B. TRANSISTOR OVERHEATING
Operate a working monitor for 30 minutes or more, and *remove AC power.* Finger touch of transistors will indicate normal operating temperatures. This can be compared to non-working monitor.

C. POWER SUPPLY:
Measure DC supply voltages to determine regulator operation. Voltages at printed circuit board terminals:

#2	75V	Adjust R212
#3	155V	Developed by horiz. def. transformer and will vary with width adjustment.
#28	550V	
#7	28V	

D. INDIVIDUAL CIRCUIT ANALYSIS:

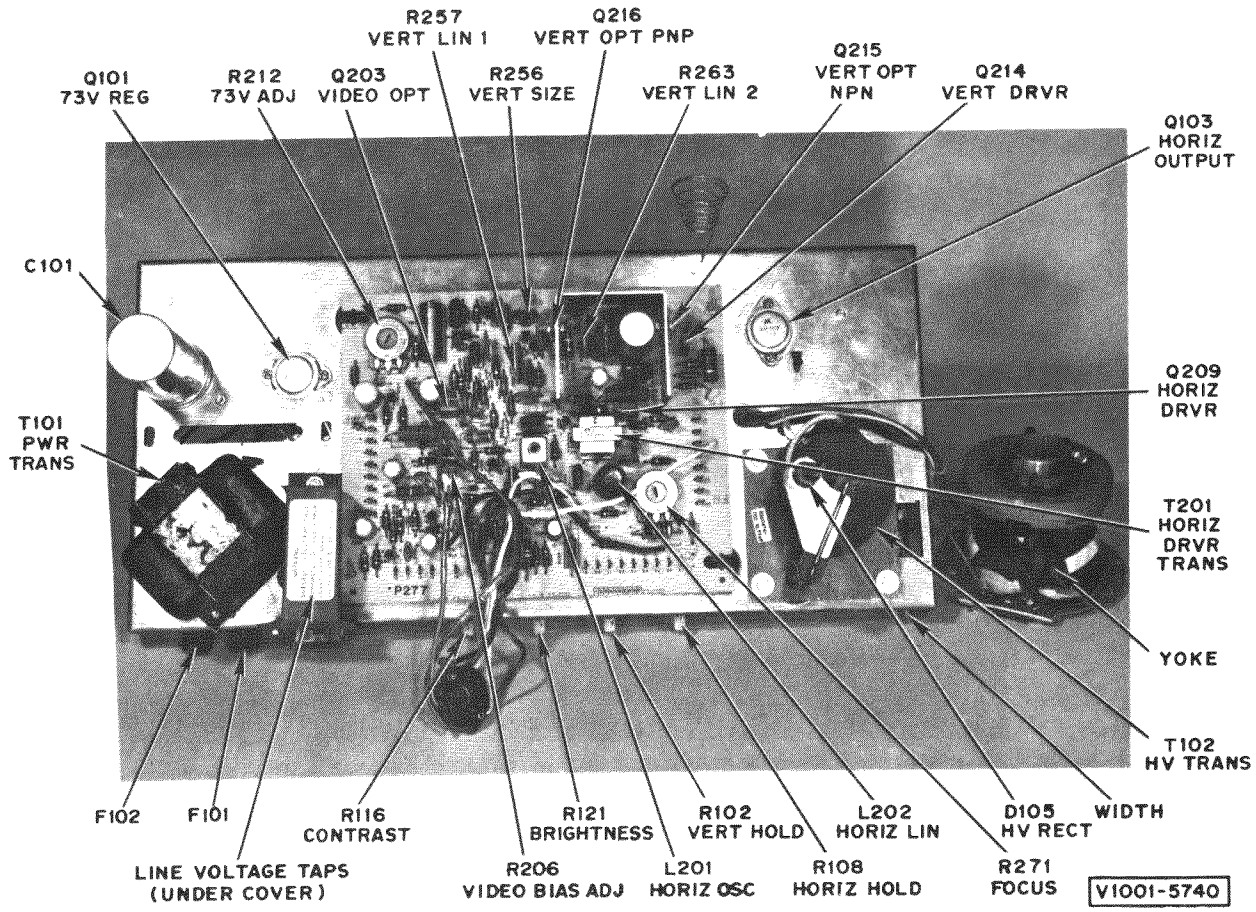
DC. voltage measurements, using a meter with a 1 megohm or higher input, is useful in analyzing circuit faults in the power supply and video amplifier sections. When measuring DC voltages in the video amplifier, the contrast control must be turned to minimum. The video bias adjustment of 45V at Q203 should be attempted first.

Scope waveforms are useful when checking the synchronizing circuit or vertical and horizontal deflection circuits. Waveforms can be compared to the scope photos in the service manual.

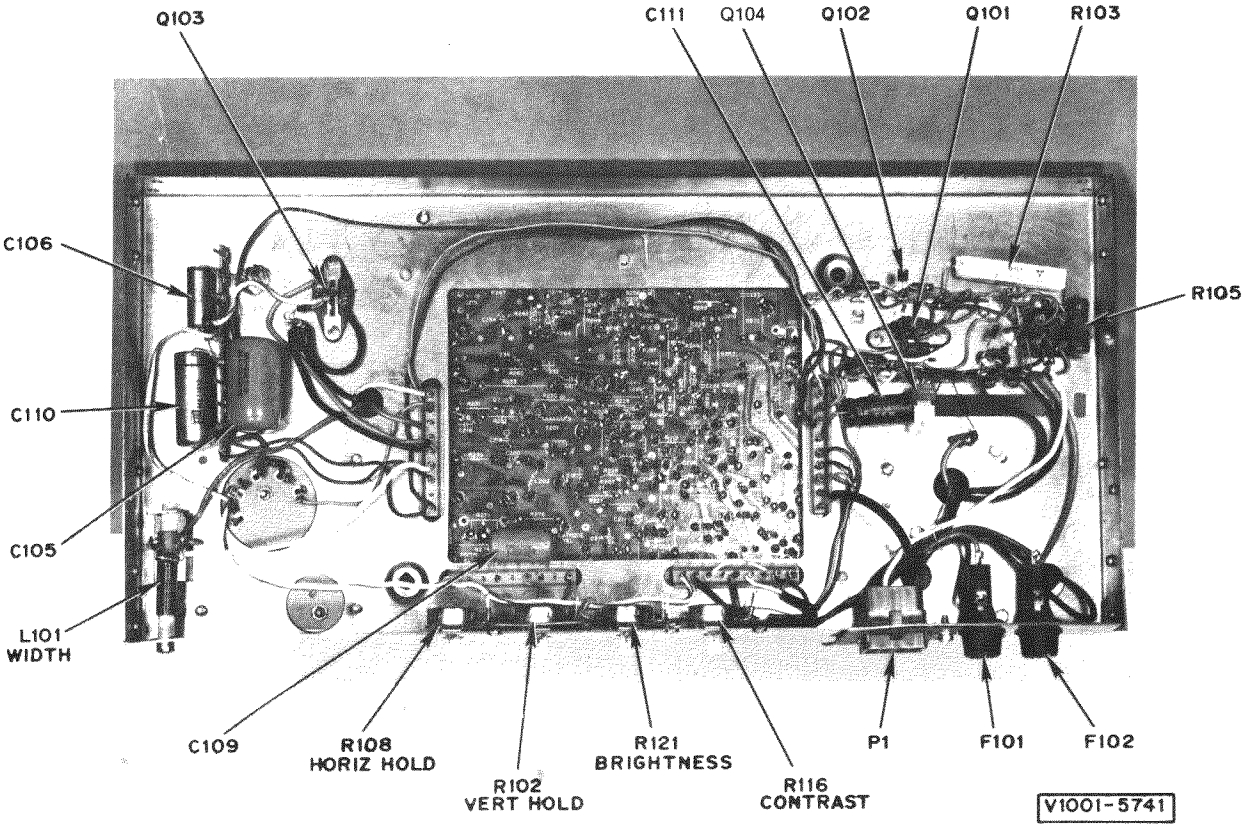
An ohm meter may be used to check for a shorted transistor or diode. In some cases, this can be done without removing the component from the circuit. When using an ohm meter, *the AC power must be removed* from the monitor.

The ohm meter may be used to check the horizontal output section in cases where it is known that this circuit is in a state of high current drain. Q103 and D106 can be checked by measuring the resistance from collector to ground. The meter leads are then reversed and a second reading is made. One reading will be a low reading, this is normal. The second reading will be 2,000 ohms or more unless Q103 or D106 are shorted. D107 and D206 can be checked by comparing the forward and reverse resistance of the diode.

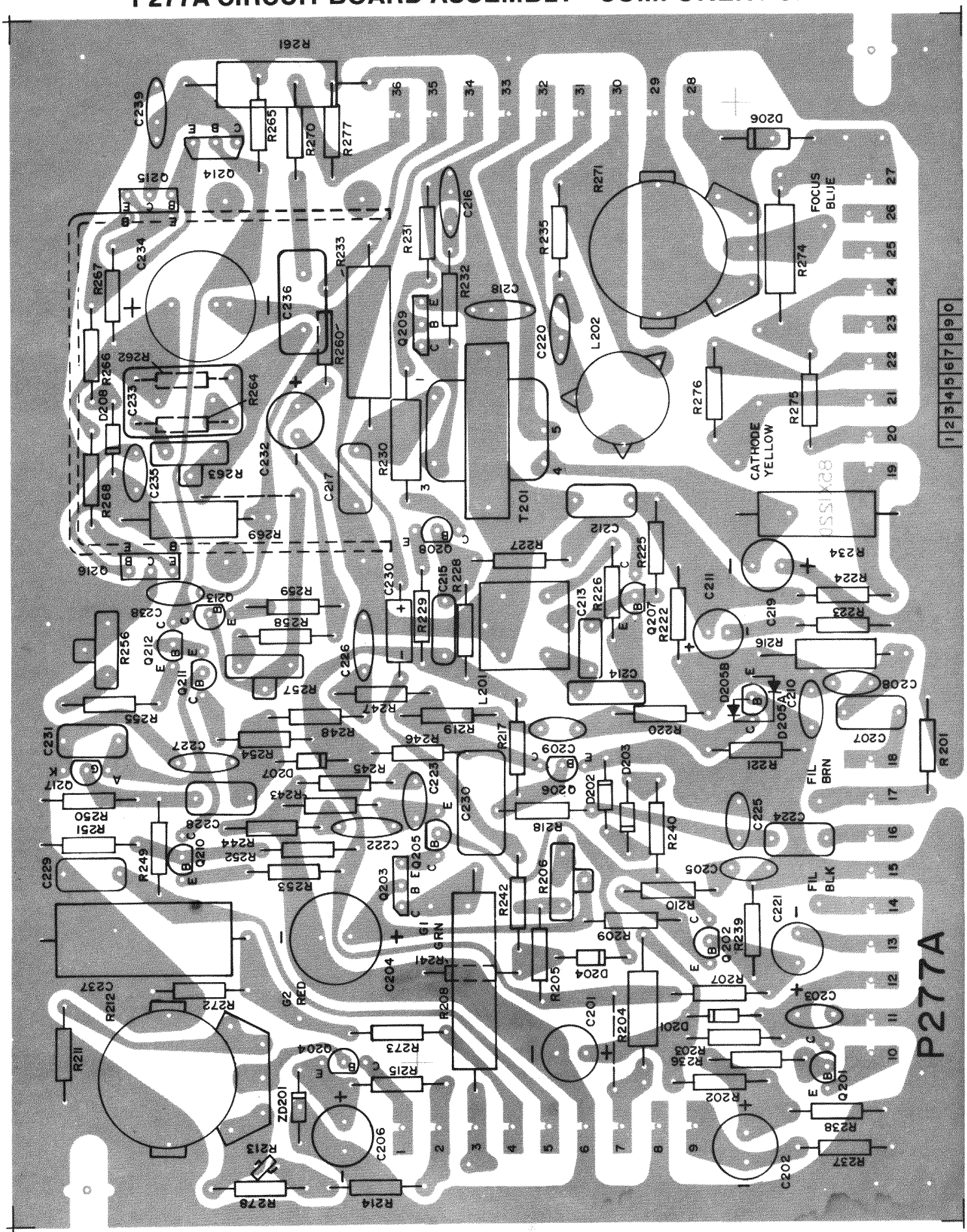
COMPONENT LOCATION—TOP CHASSIS



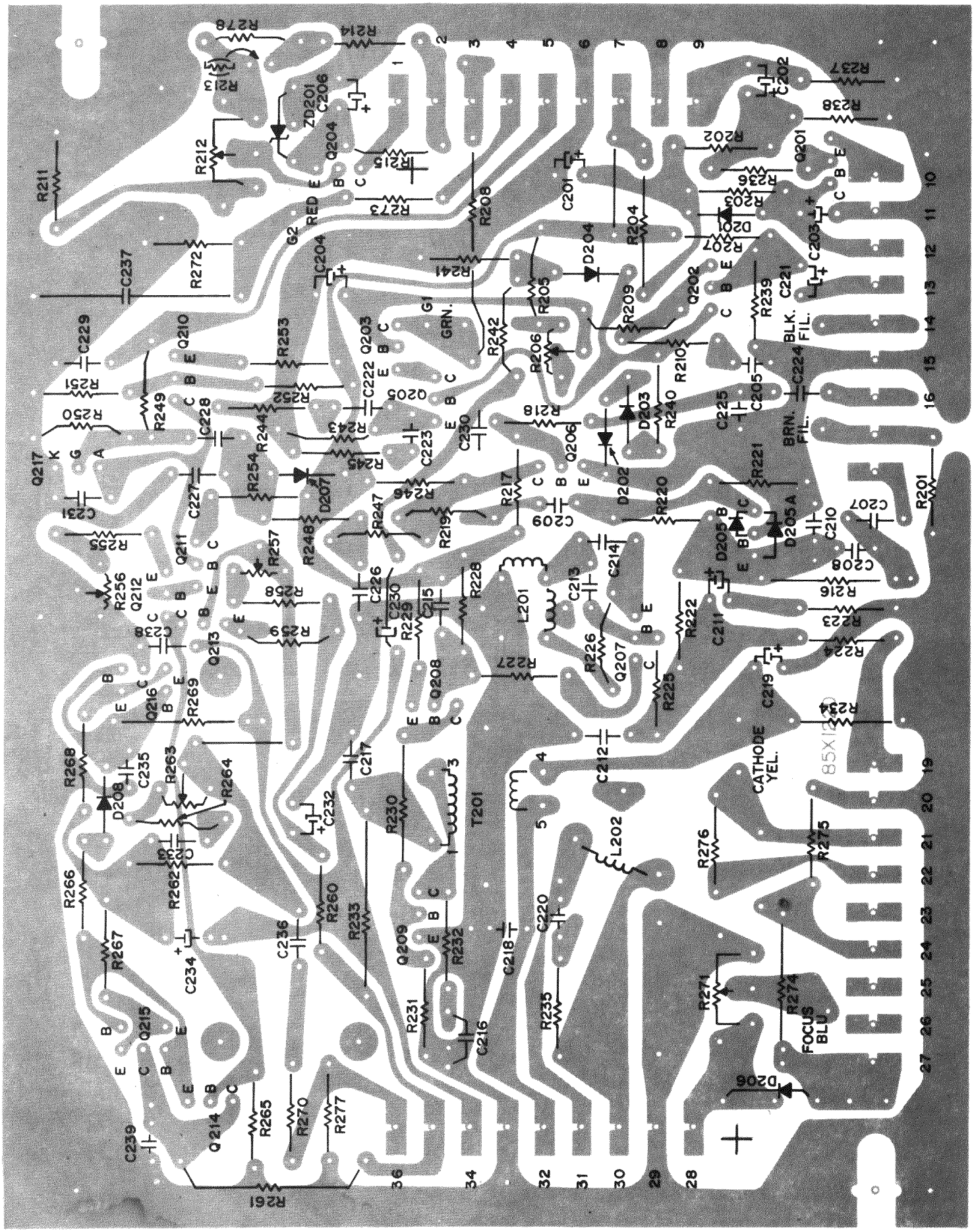
COMPONENT LOCATION—BOTTOM CHASSIS



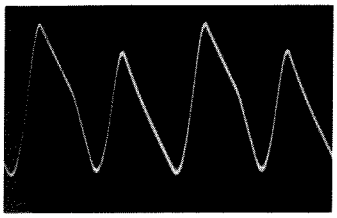
P277A CIRCUIT BOARD ASSEMBLY—COMPONENT SIDE



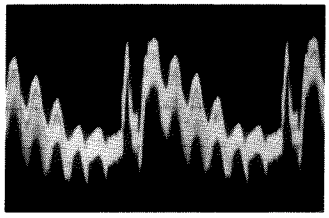
P277A CIRCUIT BOARD ASSEMBLY—WIRING SIDE



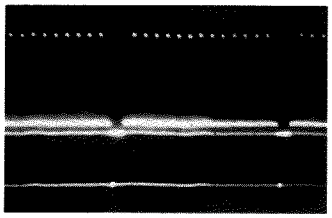
CHASSIS VOLTAGE WAVEFORMS



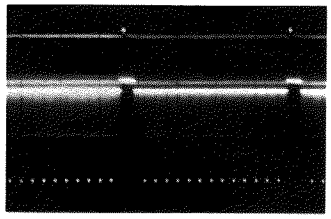
1. Vert. Rate 3V P-P



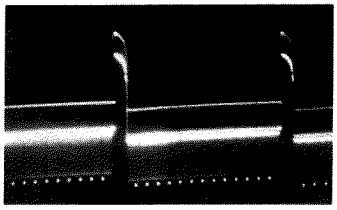
2. Horiz. Rate 0.3V P-P



3. Vert. Rate 0.5V P-P

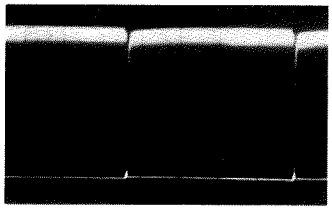


4. Vert. Rate 1.3V P-P



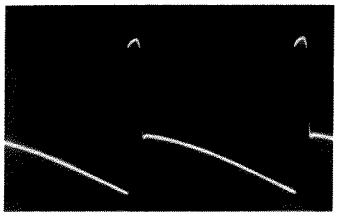
5. Vert. Rate 3.7V P-P

6. Vert. Rate 80V P-P

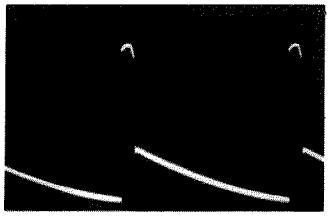


7. Vert. Rate 23V P-P

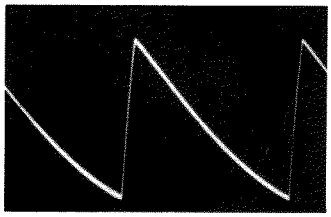
8. Vert. Rate 7V P-P



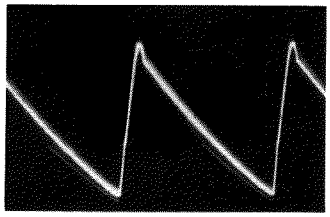
9. Vert. Rate 35V P-P



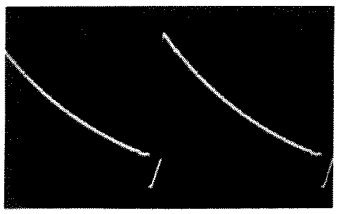
10. Vert. Rate 37V P-P



11. Vert. Rate 2V P-P

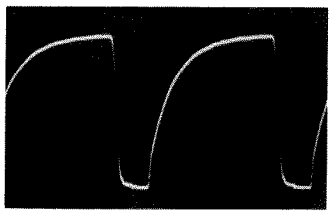


12. Horiz. Rate 9V P-P

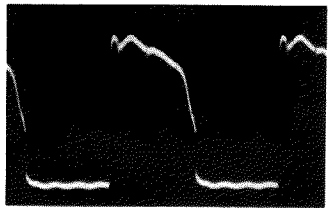


I3. Horiz. Rate 20V P-P

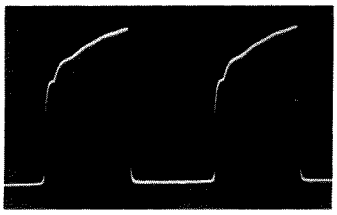
14. Horiz. Rate 23V P-P



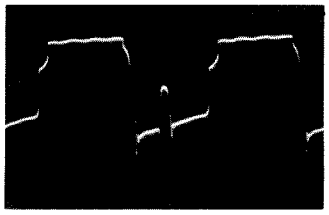
15. Horiz. Rate 3.6V P-P



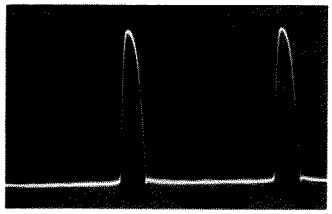
16. Horiz. Rate 0.8V P-P



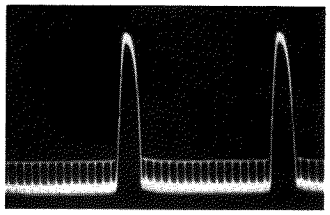
17. Horiz. Rate 110V P-P



18. Horiz. Rate 3V P-P



19. Horiz. Rate 590V P-P

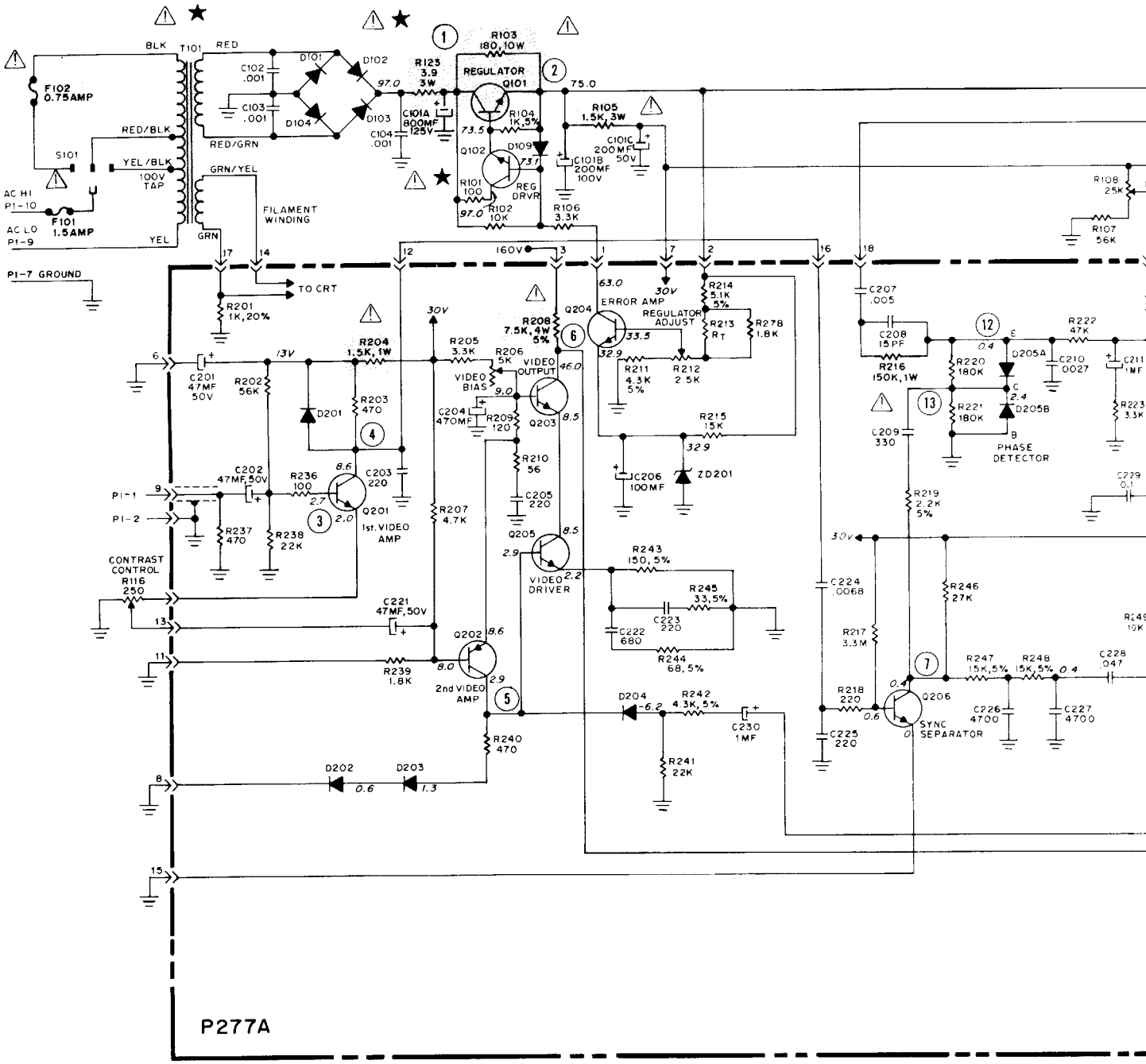


20. Horiz. Rate 100V P-P

WAVEFORM MEASUREMENTS:

TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE BAND OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED. INPUT SIGNAL 0.5V P-P COMPOSITE VIDEO N.T.S.C. SYSTEM. CONTROL POSITIONS ARE THE SAME AS THOSE USED IN D.C. VOLTAGE MEASUREMENTS.

SCHEMATIC DI



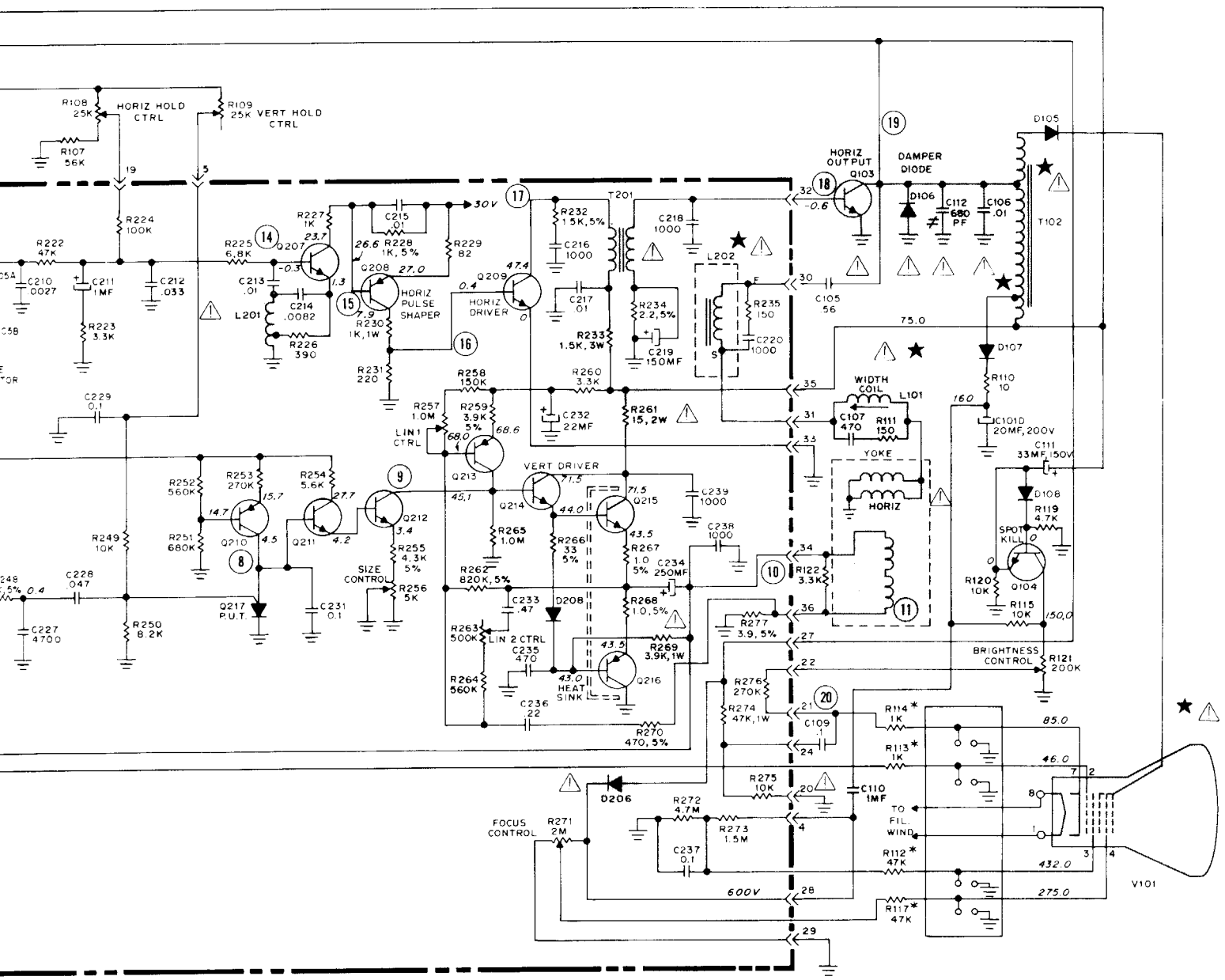
NOTES:

1. VOLTAGE MAY VARY WITH CONTROL SETTING.
2. LINE VOLTAGE MAINTAINED AT 120VAC, 50/60Hz.
3. ALL D.C. VOLTAGES ±10% MEASURED FROM POINT INDICATED TO CHASSIS USING HIGH IMPEDANCE METER WITH NO SIGNAL INPUT. CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
4. ◯ -WITH INTERNAL NUMBER INDICATES LOCATION OF WAVE FORM READING.

⚠ PRODUCT SAFETY NO
PARTS IDENTIFIED BY
ARE SAFETY CRITICAL
REPLACE ONLY WITH SA
PARTS SHOWN IN PAR

★ X-RAY RADIATION REL
REPLACEMENT PURPOS
TYPE PARTS SHOWN I

IATIC DIAGRAM



RODUCT SAFETY NOTICE:

ARTS IDENTIFIED BY SHADING AND BY ⚠ ARE SAFETY CRITICAL COMPONENTS. EPLACE ONLY WITH SAME TYPE ARTS SHOWN IN PARTS LIST.

-RAY RADIATION RELATED PARTS FOR EPLACEMENT PURPOSES, USE ONLY YPE PARTS SHOWN IN PARTS LIST.

NOTES:

* INDICATES RESISTORS LOCATED IN PICTURE TUBE LEAD ASSEMBLY.

RESISTANCE VALUES IN OHMS, 1/2 WATT, 10% UNLESS OTHERWISE NOTED. K=1,000 M=1,000,000

CAPACITANCE VALUES OF 1 OR LESS ARE IN MICROFARADS. ABOVE 1 IN PICOFARADS UNLESS OTHERWISE NOTED.

≠ C112 NOT USED IN ALL MODELS.

V1001-5734B

★

SERVICE TECHNICIAN WARNING X-RAY RADIATION PRECAUTION:
THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

REPLACEMENT PARTS LIST

CHASSIS PARTS

⚠

PRODUCT SAFETY NOTICE:
THE PARTS IDENTIFIED BY SHADING AND BY (⚠) ON THE SCHEMATIC DIAGRAM ARE SAFETY CRITICAL COMPONENTS.
FOR REPLACEMENT PURPOSES, USE ONLY SAME TYPE PARTS SHOWN IN THE PARTS LIST.

CAPACITORS

⚠ ★ C101A, B, C, D	45X0558-001	800 μF/125V, 200 μF/100V 200 μF/50V, 20 μF/200V Electrolytic
C102, 103 104	80X0001-000	.001 μF, GMV Z5U Cer. Disc.
⚠ C105	342X5642-049	.56 μF, 400V, 10% Polypropylene
⚠ ★ C106	46X0536-011	.01 μF, 1200V, 5% Polypropylene
C107	80X0099-006	470 pF, Z5F, 10%
C109	342X1044-040	0.1 μF, 400V, 20% Mylar
⚠ C110	46X0540-002	1.0 μF, 630V, 10% Polyester Film
C111	45X0515-032	33 μF, 150V, Electrolytic
⚠ †C112	80X0098-047	680 pF, 2KV, N1500

CONTROLS

R108, 109	40X0585-091	25k Ohm, Horiz. & Vert. Hold
R116	40X0585-090	250 Ohm, Contrast
R121	40X0585-092	200k Ohm, Brightness

COILS & TRANSFORMERS

⚠ ★ L101	9A2787-001	Coil, Width
⚠ ★ T101	53X0475-001	Transformer, Power (V1001)
⚠ ★ T101	53X0475-002	Transformer, Power (V1003)
⚠ ★ T102	53X0474-001	Transformer, Flyback

RESISTORS

R101	340X3101-941	100 Ohm, 10%, 1/2W
R102, 115, 120	340X3103-941	10k Ohm, 10%, 1/2W
⚠ R103	340X0181-341	180 Ohm, 10%, 10W, WW
R104	340X3102-931	1k Ohm, 5%, 1/2W
⚠ R105	340X6152-341	1.5k Ohm, 10%, 3W, WW
R106, 122	340X3332-941	3.3k Ohm, 10%, 1/2W
R107	340X3563-941	56k Ohm, 10%, 1/2W
R110	340X3100-941	10 Ohm, 10%, 1/2W
R111	340X3151-941	150 Ohm, 10%, 1/2W
R112, 113, 114, 117		Part of 38A5395-000 Pix Socket and Connector Assy.
R119	340X3472-941	4.7k Ohm, 10%, 1/2W
⚠ ★ R123	43X0401-049	3.9 Ohm, 10%, 3W

SEMICONDUCTORS

D101, 102 103, 104	66X0023-009	Rectifier, Silicon 500V 1N444B
⚠ D105	66X0067-001	Rectifier Varo H1802
⚠ D106	66X0068-001	Diode, Damper MR1-1600
D107	66X0069-001	Diode, 250V HS
D108, 109	66X0046-001	Diode, Silicon FDH444
⚠ Q101	86X0117-001	Transistor (NPN) 2N5632 Regulator
Q102	86X0071-001	Transistor (NPN) Reg. Driver MPSA06
⚠ Q103	86X0118-001	Transistor (NPN) BU207 Hor. Output
Q104	86X0065-001	Transistor (NPN) D40N5 Spot Kill

MISCELLANEOUS

	16X0171-001	Fuse Holder
⚠ F101	16X0176-001	Fuse, 1.5 Amp. Slo-Blo 3AG
⚠ F102	16X0175-001	Fuse, 0.75 Amp, Slo-Blo 3AG
⚠	13X1201-001	HV Lead & Recept. Assy.
	28X0789-001	Spring, Dag, Grounding
⚠	9A2786-001	Deflection Yoke & Clamp
⚠ ★ V101	19VARP4	CRT (19V1001)
or	or	
⚠ ★ V101	M50-102W	CRT (19V1001)
or		
⚠ ★ V101	22VATP4	CRT (22V1001)

★ X-Ray Radiation Related Parts

⚠ Safety Related Parts

†Used only with 19VARP4 Tube and 9A2786-100 Yoke

REPLACEMENT PARTS LIST
P277A CIRCUIT BOARD ASSY.

CAPACITORS

C201, 202, 221	45X0524-027	47 μF, 50V, Electrolytic
C203, 205, 223, 225	80X0099-057	220 pF, 10%, Z5F, Cer. Disc.
C204	45X0524-053	470 μF, 16V, Electrolytic
C206	45X0524-051	100 μF, 50V, Electrolytic
C207	80X0099-192	.005 μF, 20%, 1KV, Cer. Disc.
C208	80X0099-015	15 pF, 10%, 500V, Cer. Disc.
C209	80X0099-013	330 pF, 10%, 500V, Cer. Disc.
C210	349X2722-109	.0027 μF, 10%, Mylar
C211	45X0524-023	1.0 μF, 15V, Electrolytic
C212	349X3332-109	.033 μF, Mylar
C213	46X0541-001	.01 μF, Poly
C214	46X0541-002	.0082 μF, Poly
C215	349X1032-109	.01 μF, 10%, 100V Mylar
C216, 218, 220, 238, 239	80X0099-076	1000 pF, 10%, 500V, Cer. Disc.
C217	349X1032-209	.01 μF, 10%, 200V, Mylar
C219	45X0524-052	150 μF, 10V, Electrolytic
C222	80X0099-137	680 pF, 10%, 500V, Cer. Disc.
C224	349X6822-109	.0068 μF, 10%, 100V, Mylar
C226, 227	80X0099-056	4700 μF, 10%, 500V, Cer. Disc.
C228	349X4732-109	.047 μF, 10%, 100V, Mylar
C229	349X1044-109	0.1 μF, 20%, 100V, Mylar
C230	45X0515-014	1.0 μF, 50V, Electrolytic
C231	349X1042-109	0.1 μF, 10%, 100V, Mylar
C232	45X0524-026	22 μF, 100V, Electrolytic
C233	349X4742-109	.47 μF, 10%, 100V, Mylar
C234	45X0524-025	250 μF, 100V, Electrolytic
C235	80X0099-006	470 pF, 10%, Z5F, Cer. Disc.
C236	349X2242-109	.22 μF, 10%, 100V, Mylar
C237	342X1044-060	0.1 μF, 20%, 600V, Mylar

CONTROLS

R206, 256	40X0592-008	5k Ohm, Video Output, Size
R212	40X0585-093	2.5k Ohm, Reg. Adj.
R257	40X0592-012	I M Ohm, Lin 1
R263	40X0592-004	500k Ohm, Lin 2
R271	40X0585-094	2M Ohm, Focus

COILS & TRANSFORMERS

⚠L201	9A2788-001	Horiz. Osc.
⚠★L202	9A2789-001	Horiz. Lin.
⚠T201	52X0126-001	Horiz. Driver

RESISTORS

R201	340X3102-954	1k Ohm, 20%, 1/2W
R202	340X3563-944	56k Ohm, 10%, 1/2W
R203, 237, 240	340X3471-944	470 Ohm, 10%, 1/2W
⚠R204	340X4152-843	1.5k Ohm, 10%, 1.0W
R205, 223, 260	340X3332-944	3.3k Ohm, 10%, 1/2W
R207	340X3472-944	4.7k Ohm, 10%, 1/2W
⚠R208	340X7752-733	7.5k Ohm, 5%, 4.0W
R209	340X3121-944	120 Ohm, 10%, 1/2W
R210	340X3560-944	56 Ohm, 10%, 1/2W
R211, 242, 255	340X3432-934	4300 Ohm, 5%, 1/2W
R213	43X0467-001	Thermistor
R214	340X3512-934	5.1k Ohm, 5%, 1/2W
R215	340X3153-944	15k Ohm, 10%, 1/2W
⚠R216	340X4154-843	150k Ohm, 10%, 1.0W
R217	340X3335-944	3.3M Ohm, 10%, 1/2W
R218, 231	340X3221-944	220 Ohm, 10%, 1/2W
R219	340X3222-934	2.2k Ohm, 5%, 1/2W

RESISTORS (Cont'd.)

R220, 221	340X3184-944	180k Ohm, 10%, 1/2W
R222	340X3473-944	47k Ohm, 10%, 1/2W
R224	340X3104-944	100k Ohm, 10%, 1/2W
R225	340X3682-944	6.8k Ohm, 10%, 1/2W
R226	340X3391-944	390 Ohm, 10%, 1/2W
R227	340X3102-944	1k Ohm, 10%, 1/2W
R228	340X3102-934	1k Ohm, 5%, 1/2W
R229	340X3820-944	82 Ohm, 10%, 1/2W
R230	340X4102-843	1k Ohm, 10%, 1.0W
R232	340X3152-934	1.5k Ohm, 5%, 1/2W
R233	340X6152-743	1.5k Ohm, 10%, 3.0W
R234	340X5022-333	2.2 Ohm, 5%, 2.0W
R235	340X3151-944	150 Ohm, 10%, 1/2W
R236	340X3101-944	100 Ohm, 10%, 1/2W
R238, 241	340X3223-944	22k Ohm, 10%, 1/2W
R239, 278	340X3182-944	1.8k Ohm, 10%, 1/2W
R243	340X3151-934	150 Ohm, 5%, 1/2W
R244	340X3680-934	68 Ohm, 5%, 1/2W
R245, 266	340X3330-934	33 Ohm, 5%, 1/2W
R246	340X3273-944	27k Ohm, 10%, 1/2W
R247, 248	340X3153-934	15k Ohm, 5%, 1/2W
R249, 275	340X3103-944	10k Ohm, 10%, 1/2W
R250	340X3822-944	8.2k Ohm, 10%, 1/2W
R251	340X3684-944	680k Ohm, 10%, 1/2W
R252, 264	340X3564-944	560k Ohm, 10%, 1/2W
R253, 276	340X3274-944	270k Ohm, 10%, 1/2W
R254	340X3562-944	5.6k Ohm, 10%, 1/2W
R258	340X3154-944	150k Ohm, 10%, 1/2W
R259	340X3392-934	3.9k Ohm, 5%. 1/2W
⚠R261	340X5150-843	15 Ohm, 10%, 2.0W
R262	340X3824-934	820K Ohm, 5%, 1/2W
R265	340X3105-934	1M Ohm, 10%, 1/2W
R267, 268	340X3010-934	1 Ohm, 5%, 1/2W
⚠R269	340X4392-843	3.9K Ohm, 10%, 1W
R270	340X3471-934	470 Ohm, 5%, 1/2W
R272	340X3475-944	4.7M Ohm, 10%, 1/2W
R273	340X3155-944	1.5M Ohm, 10%, 1/2W
⚠R274	340X4473-843	47k Ohm, 10%, 1.0W
R277	340X3039-934	3.9 Ohm, 5%, 1/2W

SEMICONDUCTORS

D201, 202, 203, 204 208, 209	66X0046-001	Diode, Silicon FDH444
D205A, 205B	66X0066-001	Diode, Dual, MSD6102
⚠D206	66X0054-002	Diode, RCA D2102SF
Q201, 205, 206	86X0113-001	Transistor (NPN) 2N3904
Q202, 208	86X0114-001	Transistor (PNP) 2N3906
Q203	86X0115-001	Transistor (NPN) D40P3
Q204, 212	86X0071-001	Transistor (NPN) MPSA06
Q207	86X0121-001	Transistor
Q209	86X0116-001	Transistor Horiz, Driver (NPN) 2N6557
Q210	86X0066-001	Transistor (PNP) MPSA70
Q211	86X0120-001	Transistor
Q213	86X0072-001	Transistor (PNP) MPSA56
Q214	86X0073-001	Transistor (NPN) MPSU07
Q215	86X0074-001	Transistor (NPN) 2N5192
Q216	86X0075-001	Transistor (PNP) 2N5195
Q217	86X0070-001	Transistor (P.U.T.) MPU131
ZD201	66X0040-004	Diode, Zener 31V

MISCELLANEOUS

38A5395-000	Pix Socket & Connector Assy.
38A5358-000	Circuit Board Assy.

★ X-Ray Radiation Related Parts

⚠ Safety Related Parts

wells-gardner
ELECTRONICS
CORPORATION

BLACK AND WHITE TV MONITORS

MODELS

V1001—CHASSIS ONLY
19V1001—19" CRT
19V1002—19" CRT
19V1003—19" CRT
22V1001—22" CRT
22V1003—22" CRT

SUPPLEMENTARY SERVICE INFORMATION

THE FOLLOWING CHANGES REFER TO BLACK & WHITE T.V. MONITORS V1001, 2 and 3 SERIES.

Plug in module P277A was used with the 19V1001 & 19V1003. The new module P292 is directly interchangeable with P277A.

Plug in module P289 was used with the 19V1002. The new module P293 is directly interchangeable with the P289.

Major changes were made in the vertical oscillator drive and output circuit.

Linearity control #2 has been eliminated and R280 top balance control has been added. R280 should be adjusted as follows: The top balance control is a factory adjusted control and normally will not require re-adjustment in service. This control is used to position the scanning lines at the top of the display (start of vertical scan). This control may be adjusted when the contrast control is turned to minimum. The size control in some units may have to be reduced to expose the start of the vertical scan.

FOLLOWING ARE THE COMPLETE CHANGES MADE FOR EACH TWO BOARD TYPES

P277 to P292

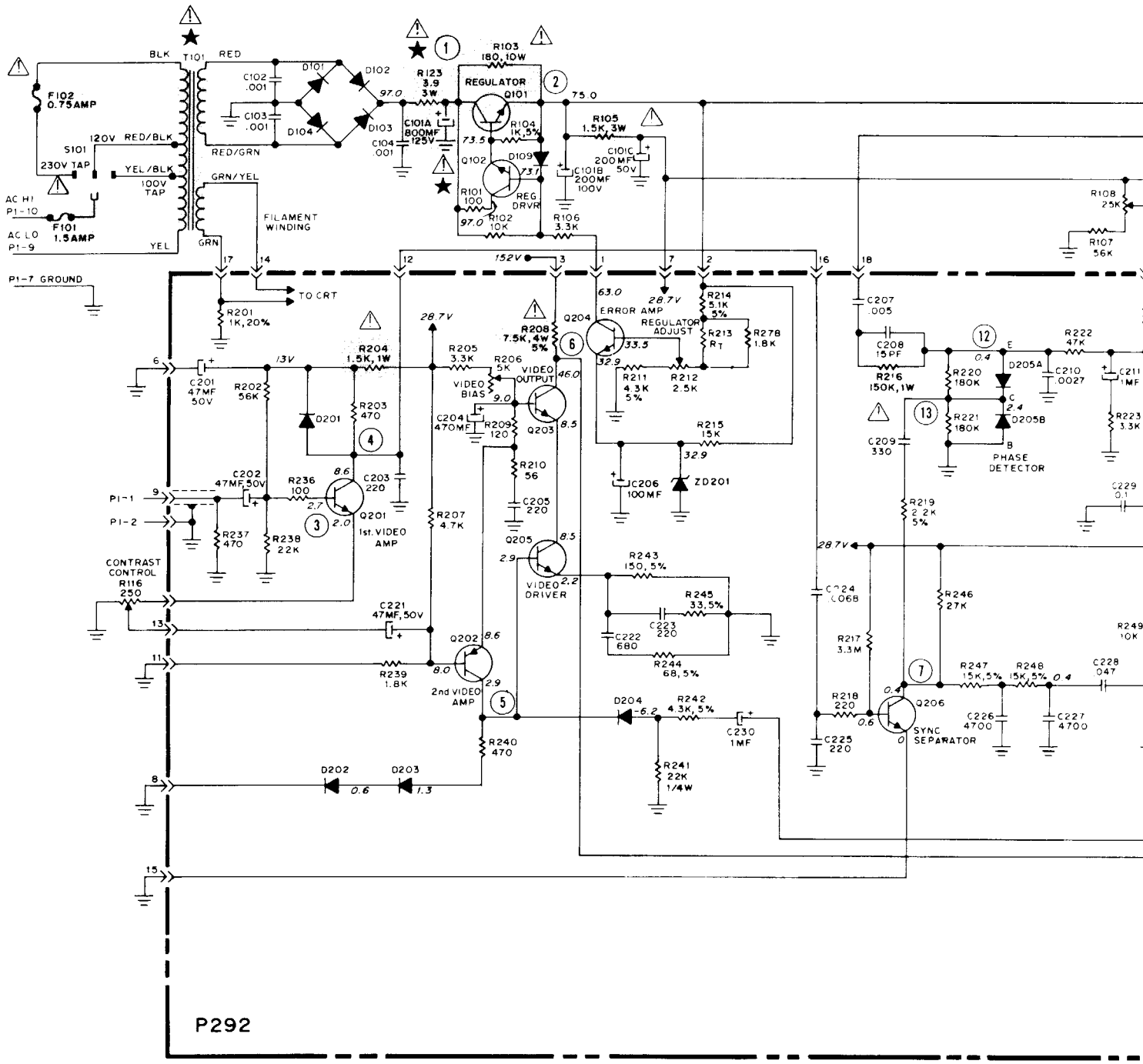
VALUE CHANGED	REMOVED	ADDED
R258-150K to 100K	R264-560K	R280-1MEG control
R273-1.5MEG to 1MEG	R263-500K (Lin 2)	R281-1MEG
R256-5K to 7K	R265-1MEG	C240-.22 100V
	C233-.47	R282-220K

P289 to P293 (19V1002 ONLY)

VALUE CHANGED	REMOVED	ADDED
R258-150K to 100K	R264-560K	R279-680K
R272-2.7MEG to 4.7MEG	R263-500K (Lin 2)	R280-1MEG Control
R256-5K to 7K	R265-1MEG	R281-1MEG
R255-REMAINS 5.6K	C233-.47MF	C240-.22 100V
		R282-220K

WELLS-GARDNER ELECTRONICS
CORPORATION
2701 NORTH KILDARE AVENUE
CHICAGO, ILLINOIS 60639
312—252-8220

SCHEMATIC D



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4. ◯ –WITH INTERNAL NUMBER INDICATES LOCATION OF WAVE FORM READING.

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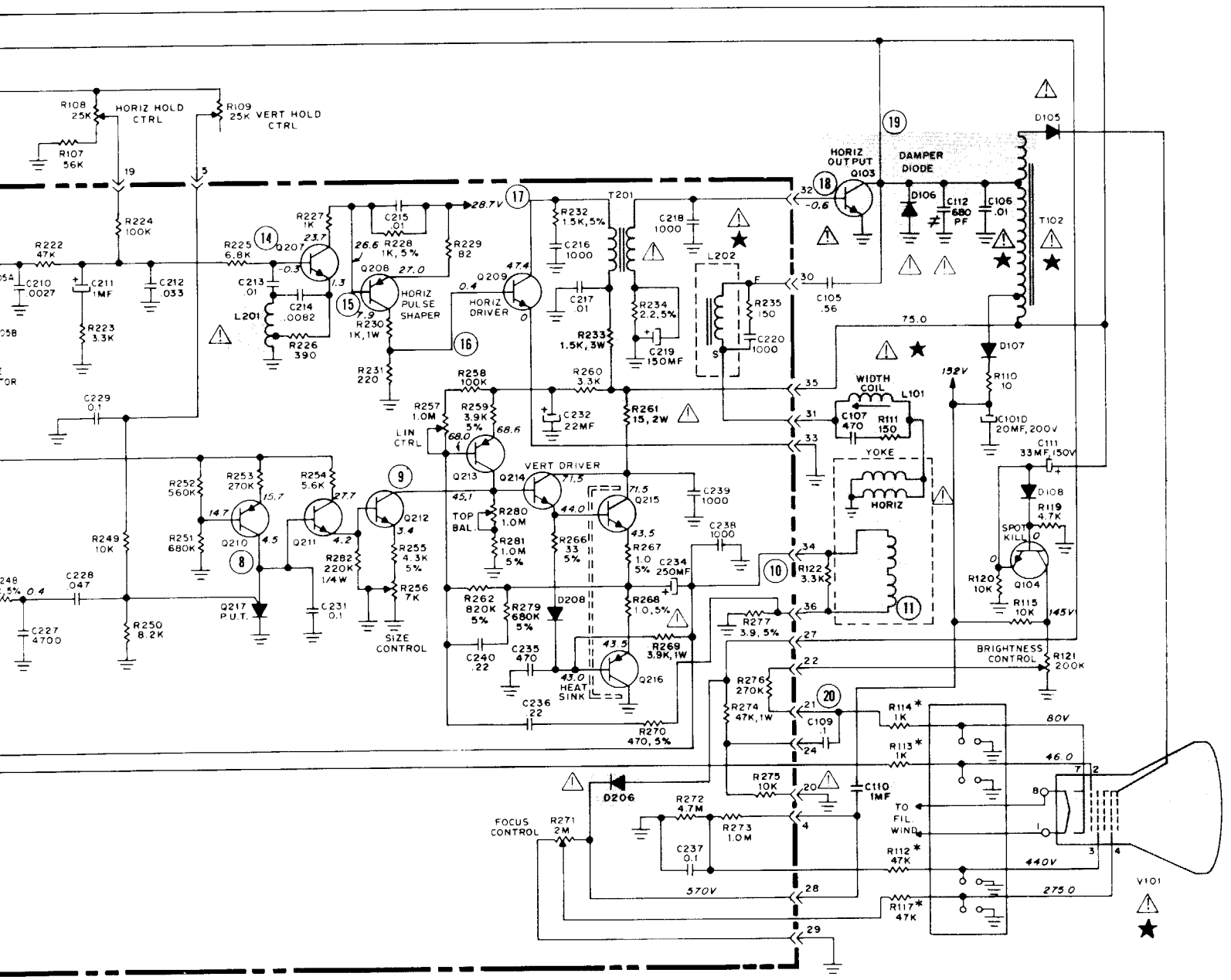
REPLACEMENT PURPOSI
TYPE PARTS SHOWN IN

EMATIC DIAGRAM



PRODUCT SAFETY NOTICE:

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NOTES:

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V1001-5787

THEORY OF OPERATION

VERTICAL OSCILLATOR DRIVER AND OUTPUT

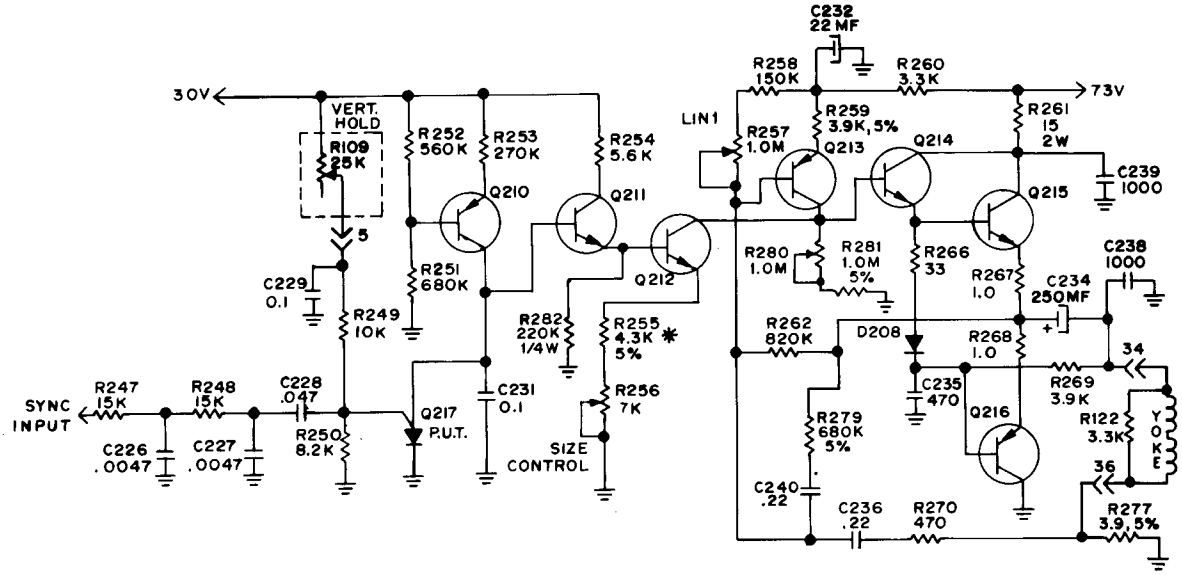
In the oscillator, transistor Q210 acts as a constant current source to charge capacitor C231. Thus, the voltage across C231 increases linearly with time. Capacitor C231 is discharged by the programmable unijunction transistor (put) Q217. Q217 will turn on if the free running frequency of the oscillator which is controlled by the gate voltage level with R109 is close to that of the negative going sync pulses. Q211 serves as a buffer between the oscillator and the amplifier to prevent non linear charging of capacitor C231.

In the amplifier, Q212 serves as a voltage controlled current source. Q213 acts as a constant current source such that Q214 and Q215 are turned on when the oscillator voltage is low. As the oscillator voltage increases increasing Q212 collector current, decreasing base current of Q214, Q214 and Q215 will be cut off and Q216 will conduct.

Beginning of retrace time zero oscillator voltage cuts off Q212. Q214 and Q215 become biased on and Q216 biased off. However, since current cannot change abruptly through inductive load yoke, suddenly output voltage will increase. Since Q213 is biased through R262, during retrace time high output voltage causes Q213, Q214 and Q215 to cutoff and Q216 to turn on (due to low voltage drop through R269) until the yoke current goes to zero. When the yoke current (output current) reaches zero, the output voltage begins to fall. This causes Q215 to turn on and Q216 to turn off, thus, completing the current reversal.

In order to maintain linearity, and desired s-correction, current feedback is provided by R277, R258, R257 and C236, and second AC feedback is used by R279 and C240.

Height control is achieved by varying the collector current swing in transistor Q212 with potentiometer R256.



VERTICAL OSCILLATOR DRIVER & OUTPUT
PART OF P292 PCB

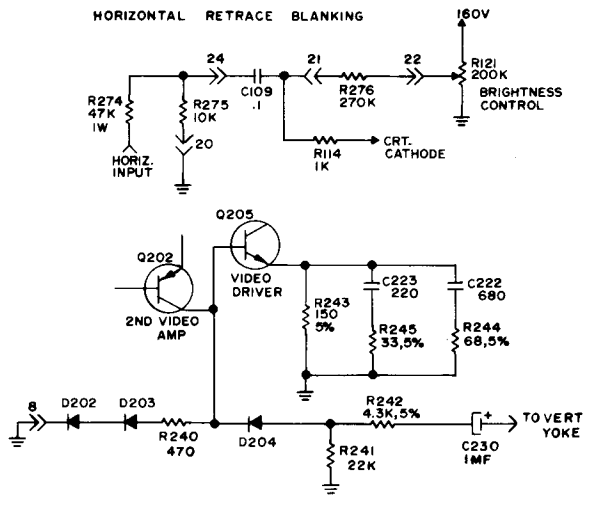
V1001-5738C

* 5.6K, 10% USED IN P293 PCB

RETRACE BLANKING

Vertical retrace blanking is accomplished by applying a positive pulse to the base of the video driver Q205. Diode D204 is used to block the sawtooth portion of the vertical wave form. The blanking pulse will appear at the collector of the video output amplifier which is directly coupled to CRT grid.

Horizontal retrace blanking is provided by a positive pulse applied to the CRT cathode. This pulse originates at the collector of the horizontal output device. The pulse amplitude is reduced by voltage divider R274 and R275. C109 is used to couple this blanking pulse to the CRT.



VERTICAL RETRACE BLANKING

V1001—5739